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Definition of Swarm Intelligence Applications –

Businesses employ a lot of surveys, statistical and data analysis tools to understand the problems faced by the production (https://www.educba.com/course/production-management-course/), marketing (https://www.educba.com/marketing-planning-process/), inventory (https://www.educba.com/course/inventory-management/) or warehousing (https://www.educba.com/7-steps-involved-in-building-data-warehousing/). However scientific they are, they often don't give the required solutions.

Rebranding and Avoiding The Pitfalls (https://www.educba.com/rebranding-exercise)

9 Helpful Ways Of Funding Requirements for Startup Business (https://www.educba.com/funding-requirements)

6 Methods Of Successful

A new theory developed from observation of animal behavior –ants, bees, and butterflies have led to the development of swarm intelligence applications. Scientists observed that social insects were largely self-organized entities who co-ordinated their activities through communication (https://www.educba.com/how-to-develop-good-communication-skills/) with nearest members in the environment. This works well in finding out the shortest route to a destination, avoiding predators or finding food is the swarm intelligence definition.

Swarm intelligence definition defines that the interesting scientific insights have led to interesting applications in business that solved a vexing problem and helped improve the bottom line of a company.

Here are examples of how swarm intelligence applications have helped various industries solve their problems;

#1 Swarm intelligence applications help in logistics and transportation business

The concept of swarm intelligence applications has been successfully used in transportation and logistics that involve the complex movement of goods along different routes. The South West Airlines had difficulty in storing cargo in airports with its capacity running at full load most of the time. However, its flights had only 7% of the cargo space occupied. In this swarm intelligence examples, They followed the intelligence of the ants which search for food by leaving distinct chemical trails –called pheromones. As more ants follow the trail they leave more chemical trails along the route.

South West Airlines decided to follow the formula and send cargo to flights to one or two other destinations before landing in the target destination. This helped them reduce freight transfer rates by a hefty 80% and reduced workload for cargo staff by 20%. The airline was able to substantially reduce storage space and accompanying wage costs. The swarm intelligence applications helped the airline to make annual gains of about $10 mn. Their cargo space was also fully booked and leading to a new business avenue for the company.

In Switzerland, Pina Petroli, heating oil company that supplies directly to homes had small, large and medium-sized trucks deployed along various routes. Traffic constraints, bad weather, narrow routes, emergency calls, different sizes of trucks and hoses, the sheer size of the operations necessitated the company to look for an innovative solution. They followed the ant principle, large trucks weren't allowed in narrow routes, there was real-time information interchange between vehicles so that fleet utilization was optimized and the nearest truck attended a home call. It also reduced travel time. Each truck served as an 'ant' leaving trails on the way for others to understand and respond.

Air Liquide, a supplier of industrial, medical gases such as nitrogen, hydrogen, and oxygen used multiple ways to deliver the products to industrial sites, hospitals using railcars, trucks, pipelines. With power prices fluctuating and having t deliver gases at 6000 sites became a complex operation for the company. It took inspiration from the ant intelligence and with the help of an artificial intelligence company evolved a model that optimized the operations of the company based on weather, plant schedules, and truck routes.

However, it is not an entirely automated system- every night the company inputs data on consumer demand and manufacturing costs so that the entire system will get organized in four hours with the swarm intelligence algorithm working out the permutations and combinations. Thus a truck driver may be directed not necessarily to pick gas from the nearest plant but depending on the lowest price available it could be farther away. It led to huge savings for the company although the drivers couldn't understand how.

In warehousing business, the bucket brigade approach of ants has been successfully used by retail chains, distribution centers at leading companies such as Bantam-Doubleday-Dell Distribution, McGraw-Hill, Blockbuster Music among others. Ants distribute food from the food source to the next through a relay principle, each passing on food to next person in the chain. This model can be successfully deployed in cases where goods have to be passed from one person to another – the duo of John Bartholdi, Georgia Tech –Donald Eisenstein, Chicago University mimicked this system for a retail chain which was using a zone approach whereby each worked completed a particular task before another person can begin.

In this process, the fastest people may be underutilized and slower people made to do more work. Bartholdi and Eisenstein devised a strategy where a worker continued to work (fill orders) till the person downstream took over his work. Thereafter, the worker can go upstream to take over the next person's work. In this system, the slowest was put at the beginning and fastest at the end. This lead to productivity gains of 30% at the warehouse compared to the zone approach.

Swarm intelligence algorithm can also help courier and parcel companies to route the cargo or documents more efficiently by optimizing resources.

#2 Swarm intelligence applications help in telecommunication business

Telecommunication business is quite complex as some routes will be busy at some point of time while others will be idle. Each call has to go through a series of intermediate nodes and hubs before it can reach the destination. How to optimize the use of the networks so that congestion and delays are avoided?

Engineers at Hewlett Packard devised a huge number of ‘digital ants’ that can be sent along uncongested networks. This helped telecom center agents to divert traffic through those routes. If an uncongested route suddenly became crowded the ‘digital ants’ will slow down or evaporate. This helps agents ignore the routes and look elsewhere. Some of the leading telecom companies such as British Telecom, France Telecom, and MCI WorldCom were the early adopters of such innovations. It also helps in routing internet traffic along least congested routes so that net users don’t face accessibility problems.

#3 Swarm intelligence applications help optimize factory operations

This is one of the best swarm intelligence examples in which manufacturing operations have benefitted from the observation of how bees allocate work among themselves. There are worker bees, queen bees and nursing bees in a beehive. When workload increases, even the nursing bees help the worker bees to complete a task. This was effectively used in paint booths in a truck manufacturing facility. Each paint shop specialized in a particular paint unless it was urgently called to clear any backlog in other booths. This enabled optimization through the self-organized system instead of a centralized system for devising schedules. If a particular paint shop ran into trouble others would compensate.

Unilever optimized its plant schedules using swarm intelligence algorithm managing the complexities of a chemical plant when traditional practices couldn't do it. Among the machinery and objects used were chemical mixers, tanks for storage, packaging lines with a different variety of operations requiring changeover times from one product to another and periodic maintenance.

Certain ingredients have to be premixed before it can be handled by the mixers. The Bios Group, the New Mexico company that provided solutions for the South West Airlines also provided the solutions for Unilever. It optimized the use of machinery in such a way that if changeover time for a machinery was less than an hour, it was not used for short tasks. The software was not concerned about getting things from one place to another at the shortest time but performing a set of tasks at the shortest time. In case of breakdown of machinery, the schedules are adjusted automatically so that production is not disrupted in the shop floor.

Recommended courses

#4 Swarm intelligence applications help in getting consumer feedback better

The most frequently used methodology to understand consumer taste and preferences is through surveys and online polls. There are ratings for films, hotels, airlines, books available online but they can't get the collective intelligence of the crowd. Box office data showed Jurassic World raking $643.3 mn the most popular film, but swarm intelligence algorithm showed it was Mad Max was the highest rated film- with movie critics giving the higher rating.

Swarm intelligence software does not use absolute numbers but the quality behind it. Recently, an experiment at Humboldt-University of Berlin and RAND Corporation revealed that a group of 12 radiologists who diagnosed skeletal abnormalities were better at arriving at correct diagnosis than individual doctors doing the diagnosis.

In online polling, it has been observed that succeeding voters are influenced by the behavior of those voted before them. In swarm intelligence algorithm, nobody is influenced or led by others. Swarming (https://www.educba.com/does-swarming-helps-agile-teams-to-grow/) is synchronous. Therefore it reflects the simultaneous decisions of participants. In a survey or poll, the average reflects only a statistic that reveals what is more popular but not the one that is more appealing to the whole population.

#5 Swarm intelligence applications in HR and recruitment

In this swarm intelligence examples, companies have followed the practice of insects in hunting for food to be applied in the recruitment of employees (https://www.educba.com/course/recrutiment-process/).

Just as ants are attracted to places where 'pheromone content' is the highest, mass recruitment strategies can be utilized where competition is low and labor market size is also small. It enables companies to get talent fast and with agility. It will enable the company to hire the best talent even before other competitors emerge and raise the wage levels. Tandem recruitment formula mimics the ant behavior in which returns from a food source with food and raises its antenna signaling a few others to go. This can be used in small and medium-sized labor markets with the high degree of competition enabling them to get people from different places at competitive prices. Group recruitment mimics the bees that does waggle dance before a new food source or a potential hive to signal others to come. When there is low competition in a huge market, group recruitment was found to be effective.

Characteristics of Swarm Intelligence applications

1. There are no leaders

In social animals, it has been observed that there are no leaders, each individual works for the welfare of others. There are no permissions required and each member works according to information received from the nearest one or collectively.

Most often they have no knowledge of the bigger picture. Among bees, two types of information are shared- food information and threat information. When some bees find a good nectar source, it performs a waggle dance to signal others it is safe. When looking for new place to set up hives, the bees perform a waggle dance to signal others. Similarly, threat information requiring urgent communication is also efficiently done by the group. All members of a bioteam are seen as leaders.

2. No orders or permissions required

In bioteams, there is no formal order issued nor permission needs to be taken to undertaken to do a task as the structure is based on information sharing. The system is transparent and there is a clear understanding of each one's role in it. Orders have to be properly understood in its context and more likely to contain errors. Permission structures are present in most management systems – it is alright to have that if an employee's skills are in doubt not when it is used over uncertainty on commitment or motives of team members.

3. Speed and agility important

One reason why there is no hierarchy or orders in bioteams is that speed and agility are crucial for survival. In aviation, Roger denotes receipt of a message while Wilco denotes receipt and willingness to act on the message. An organization would perform better if more Rogers than Wilcox has to be sent.

Swarm Intelligence applications Conclusion

Swarm intelligence software has been used across industries in the past one-and-a-half decades with amazing results and its further use is only limited by our imagination. Companies who get saturated in one industry or at full capacity in one place can think of how bees find alternative places to set up hives to expand its activities. However, the expansion or diversification should be into territories that are safe and pose less risk to the organization. Similarly, when a top performer is likely to leave an organization, the management gives more incentives in the form of stock

options or shares to keep them. In beehives, queen bees give the right to lay eggs to worker bees who are likely to leave.

Swarm intelligence software is not easily accepted in some organization and therefore proper awareness building is required.

Recommended Articles

This has been a guide to the concept of swarm intelligence applications has been successfully used in transportation and logistics that involve a complex movement of goods along different routes. These are the following external link related to swarm intelligence applications.

1. Does Swarming Help Agile Teams to Grow? (Project) (https://www.educba.com/does-swarming-helps-agile-teams-to-grow/)
2. Artificial Intelligence Applications Across Sectors (https://www.educba.com/artificial-intelligence-applications-across-sectors/)
3. Artificial Intelligence vs Business Intelligence – Learn 6 Useful Comparison (https://www.educba.com/artificial-intelligence-vs-business-intelligence/)

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